



Standard Practice for Nitric Acid Digestion of Solid Waste¹

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1. Scope

1.1 This practice describes the digestion of solid waste using nitric acid for the subsequent determination of inorganic constituents by argon plasma emission spectroscopy or atomic absorption spectroscopy.

1.2 The following elements may be solubilized by this practice:

aluminum	manganese
beryllium	mercury
cadmium	nickel
chromium	phosphorus
copper	vanadium
iron	zinc
lead	

1.3 This practice is to be used when the concentrations of total recoverable elements are to be determined from a waste sample. Total recoverable elements may or may not be equivalent to total elements, depending on the element sought and the sample matrix. Recovery from refractory sample matrices, such as soils, is usually significantly less than total concentrations of the elements present.

NOTE 1—This practice has been used successfully for oily sludges and a municipal digested sludge standard [Environmental Protection Agency (EPA) Sample No. 397]. The practice may be applicable to some elements not listed above, such as arsenic, barium, selenium, cobalt, magnesium, and calcium. Refractory elements such as silicon, silver, and titanium are not solubilized by this practice.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 7.

2. Referenced Documents

2.1 ASTM Standards:

D 1193 Specification for Reagent Water²

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D19 on Water²

¹ This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.06 on Analytical Methods.

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² Annual Book of ASTM Standards, Vol 11.01.

D 3223 Test Method for Total Mercury in Water²

D 3682 Test Method for Major and Minor Elements in Combustion Residues from Coal Utilization Processes³

D 3919 Practice for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry²

D 4503 Practice for Dissolution of Solid Waste by Lithium Metaborate Fusion⁴

D 4698 Practice for Total Digestion of Sediment Samples for Chemical Analysis of Various Metals⁵

E 50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials⁶

3. Summary of Practice

3.1 A weighed portion of the waste sample is mixed with 1 + 1 nitric acid (HNO₃) in an Erlenmeyer flask. The flask is heated for 2 h at 90 to 95°C to dissolve the elements of interest. After cooling, the contents of the flask are diluted with reagent water and filtered, and the filtrate is made up to appropriate volume for subsequent analysis.

4. Significance and Use

4.1 A knowledge of the inorganic composition of a waste is often required for the selection of appropriate waste disposal practices. Solid waste may exist in a variety of forms and contain a range of organic and inorganic constituents. This practice describes a digestion procedure which dissolves many of the toxic inorganic constituents and produces a solution suitable for determination by such techniques as atomic absorption spectroscopy, atomic emission spectroscopy, and so forth. The relatively large sample size aids representative sampling of heterogeneous wastes. The relatively small dilution factor allows lower detection limits than most other sample digestion methods. Volatile metals, such as lead and mercury, are not lost during this digestion procedure. Hydride-forming elements, such as arsenic and selenium, may be partially lost. Samples with total metal contents greater than 5 % may give low results. The analyst is responsible for determining whether this practice is applicable to the solid waste being tested.

³ Annual Book of ASTM Standards, Vol 05.06.

⁴ Annual Book of ASTM Standards, Vol 11.04.

⁵ Annual Book of ASTM Standards, Vol 11.02.

⁶ Annual Book of ASTM Standards, Vol 03.05.